

EPIDEMIOLOGICAL STUDIES ON PRIMARY COXARTHROSIS

by

Håkan Lindberg



Malmö 1985



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Lars Danielsson, Håkan Lindberg and Bo Nilsson. Clin. Orthop. 191:110, 1984.
- IV. THE RELATION BETWEEN LABOR AND COXARTHROSIS.
Håkan Lindberg and Lars Danielsson. Clin. Orthop. 191:159, 1984.
- V. PREVALENCE OF PRIMARY COXARTHROSIS IN SIBLINGS OF PATIENTS WITH PRIMARY COXARTHROSIS.
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In the thesis the papers are referred to by their Roman numerals.

CONTENTS

Page

INTRODUCTION

Primary coxarthrosis - roentgenological diagnosis	5
Primary coxarthrosis - secondary coxarthrosis	6
Coxarthrosis prevalence	6
Coxarthrosis - heredity	7
Coxarthrosis - occupation	8
Coxarthrosis - sports	8
Coxarthrosis - over-weight	8
Coxarthrosis - other arthrosis	8
Coxarthrosis - mortality	9
Aim of the study	9

DISCUSSION	10
------------	----

SUMMARY AND CONCLUSIONS	13
-------------------------	----

REFERENCES	15
------------	----

PAPERS

I	21
II	29
III	43
IV	55
V	61

INTRODUCTION

Arthrosis (osteoarthritis) primary or secondary to known agents is usually related to age. In those cases with no known causing agents - for instance, those with primary coxarthrosis - there are still hypotheses on the pathogenesis, such as the concept of the cartilage itself as the site of the primary damage (Freeman and Meachim 1979) or that of the physical changes of the subchondral bone as the first site of pathology (Radin et al. 1973). Whatever the pathogenesis, however, the basic question, "heredity or environment?", has not been answered. It is unlikely that any single factor is responsible for primary coxarthrosis - a multifactorial etiology with complicated interactions is difficult or impossible to explore unless at least one clue is given.

Primary coxarthrosis - roentgenological diagnosis

It is difficult to compare studies on the prevalence of primary coxarthrosis because of the variation in the criteria for the diagnosis. In the past, several studies of arthrosis (including coxarthrosis) have been performed by Kellgren and Lawrence (1952, 1958), Lawrence et al. (1966) and Lawrence (1969). Danielsson (1964), studying the prevalence of coxarthrosis presenting symptoms in the population of the city of Malmö did not accept periarticular osteophytes as a diagnostic criterion unless also the joint space was reduced. Danielsson demonstrated that osteophytes on the articular edges of the hip joint were not related to coxarthrosis. Kellgren and Lawrence, who, in their studies did not require joint space reduction as an absolute criterion for the diagnosis of coxarthrosis - grade 1 and 2 - found a much higher prevalence.

The roentgenologic diagnosis of coxarthrosis should be based on structural and/or joint space changes. A system for classification of the severity of changes as seen in roentgenograms was presented by Danielsson et al. (1964).

In a study on the prevalence of coxarthrosis in subjects who had been examined by means of roentgen of the colon Danielsson (1966)

specified the criterion for coxarthrosis to be a joint reduction to less than 4 mm in patients under 70 years of age, and less than 3 mm in patients 70 years and older. Fredensborg and Nilsson (1978) estimated the hip joint space in 120 normal subjects and found the normal width to be slightly more than 4 mm. Pogrund et al. (1983) measured the normal width of the hip joint to be approximately 4 mm. The width of the joint space was not related to either the age or the sex of the subject.

Kellgren and Lawrence (1957) found poor agreement between different observers concerning the confirmation of the diagnosis of coxarthrosis. In the epidemiological studies from Malmö the same observer classified all films - an important factor for the validity of comparisons between these studies.

Primary coxarthrosis - secondary coxarthrosis

Murray (1965) studied the presence of minor anatomical abnormalities in the pelvic radiographs of 200 cases of primary coxarthrosis. He concluded that 25.5 per cent of the coxarthrosis cases were associated with acetabular dysplasia, and 39.5 per cent had a tilt deformity, suggesting a traumatic disturbance of the proximal femoral epiphysis during adolescence. Thus, coxarthrosis arising in an environment of normal anatomy was demonstrated in only 35 per cent of the cases. In a clinical, radiographical and anatomical study of 327 cases of coxarthrosis, Solomon (1976) concluded that only 8 per cent were in fact primary. In the remainder of cases a cause could be traced. Harris (1983) was of the opinion that all coxarthrosis is secondary. Reikerås and Høiseth (1982) demonstrated an increased anteversion angle of the femoral neck in coxarthrosis patients. In these patients a poor relationship between the anteversion of the femoral neck and the acetabulum was also demonstrated (Reikerås et al. 1983). On the other hand Byer et al. (1983) concluded that coxarthrosis usually developed in hips with normal radiographic geometry.

Coxarthrosis prevalence

Kellgren and Lawrence (1958) demonstrated that the prevalence of coxarthrosis - grade 3 and 4 according to Kellgren and Lawrence

(1957) including a joint space reduction - was 8.4 per cent in men and 3.1 per cent in women. Danielsson (1966) found the prevalence of primary coxarthrosis in patients over the age of 55 to be 3.4 per cent. In the study of Danielsson all subjects had been examined with a normal colon roentgen. Coxarthrosis - equally common in both sexes - was bilateral in 31 per cent.

Jørring (1980) performed a study in almost the same manner. In women the prevalence was 5.6 per cent and in men 3.7 per cent. A narrowing of the joint space to 3 mm or less, was the criterion for coxarthrosis. Severe coxarthrosis - using the criteria of Kellgren and Lawrence (1957) - was twice as common in women as in men in the age range 60 - 89 years. Coxarthrosis was bilateral in 44 per cent. In contrast to Danielsson (1966) even subjects whose colon examinations showed pathological findings had been included, as well as cases with secondary coxarthrosis.

Pogrud et al. (1982), in a study from Jerusalem, found the prevalence of coxarthrosis to be 4.1 per cent. The coxarthrosis was bilateral in 48 per cent and equally common in both sexes. Excluding subjects with secondary coxarthrosis, the prevalence of primary coxarthrosis in the population of Jerusalem was calculated to be 2.8 per cent. The studies of Pogrud et al. (1982) and Danielsson (1966) include mainly the same age groups although the sample of Pogrud et al. was considerably smaller.

Coxarthrosis - heredity

Stecher (1941, 1955) presented evidence of a genetic component in the etiology of Heberden nodes. He postulated that Heberden nodes were inherited as a single autosomal gene, dominant in women and recessive in men. A familial type of coxarthrosis has been demonstrated by Böni (1959). Some conditions which cause secondary coxarthrosis - congenital dislocation of the hip, Perthes' disease and slipped femoral epiphysis - are hereditary (Wansbrough et al. 1959, Carter and Wilkinson 1964, Wynne-Davies 1970, Rennie 1982) but primary coxarthrosis has not yet been demonstrated to be a hereditary disease. Kraus et al. (1978), however, found an increased prevalence of coxarthrosis in patients with a familial



occurrence of other types of arthritis.

Coxarthrosis - occupation

Kellgren and Lawrence (1952) failed to demonstrate an increased prevalence of coxarthrosis in laborers. Kraus et al. (1978) found that the relative risk of developing coxarthrosis was highest among those with the highest level of education. Pogrand et al. (1982) could not demonstrate a higher rate of coxarthrosis in the physically hardest working of three ethnic groups in Jerusalem. There are today no data pointing to any relationship between hard physical work and primary coxarthrosis.

Coxarthrosis - sports

Kraus et al. (1978) found a non significantly increased prevalence of coxarthrosis in patients who had been participating in high-school athletics. Klünder et al. (1980) found significantly more coxarthrosis in former soccer players than in controls. However, they found positive signs of coxarthrosis in almost 50 per cent of the former soccer players and in almost 30 per cent of the controls. These high rates of prevalence of coxarthrosis have not been demonstrated in other studies, indicating a different evaluation of the roentgen examination.

Coxarthrosis - over-weight

Danielsson (1964), Saville and Dickson (1968) and Jørring (1980) found no coincidence between coxarthrosis and over-weight. Over-weight coxarthrosis patients, however, were more disabled by their disease (Danielsson 1964, Jørring 1980). Kraus et al. (1978) demonstrated a positive relationship between coxarthrosis and over-weight.

Coxarthrosis - other arthrosis

Kellgren and Lawrence (1958) demonstrated an increased prevalence of osteoarthritis in patients with Heberden nodes. However, the osteoarthritis affected mainly the small joints and not the hip. Stecher (1964) proposed that Heberden nodes were unrelated to the occurrence of coxarthrosis. Also, Yazici et al. (1975) concluded that Heberden nodes did not coincide with coxarthrosis. On the

other hand, a coincidence between Heberden nodes and primary coxarthrosis of the hip was demonstrated by Marks et al. (1979). This coincidence was most apparent in patients with bilateral concentric loss of joint space. Brewerton (1983) demonstrated a connection between degenerative changes in the dorsal and lumbar spine and primary coxarthrosis.

Coxarthrosis - mortality

There is no evidence that coxarthrosis patients have an increased mortality rate (Danielsson 1964, Surin and Sundholm 1983).

Aim of the study

The aim of the study was:

To evaluate the morbidity and the fracture pattern in primary coxarthrosis patients.

To evaluate the mortality rate of primary coxarthrosis patients operated on with total hip replacement.

To evaluate the present prevalence of primary coxarthrosis in the population of Malmö as compared with 20 years ago.

To evaluate the relationship between heavy work and primary coxarthrosis.

To evaluate the prevalence of primary coxarthrosis in siblings of patients with primary coxarthrosis.

DISCUSSION

There was a tendency towards a higher morbidity caused by diseases of ageing in the coxarthrosis patients (I). Also, coxarthrosis patients had had more roentgen examinations, including colon roentgen. Even if roentgen examinations for the coxarthrosis were excluded, it is obvious that the coxarthrosis patients had been exposed to more medical care compared with the controls, either because of a selection factor or because they indeed have signs of a more rapid ageing process. However, their survival is not measurably affected (II) which is hardly a support for the concept of coxarthrosis as a part of general, premature ageing. One disease of the elderly - diabetes - appears to be even less common in coxarthrosis patients! (I). Coxarthrosis and osteoporosis seem to be two independent and unrelated disease processes (Poggrund et al. 1982). Foss and Byers (1972) demonstrated that coxarthrosis patients had an increased bone density in the second metacarpal bone. Carlsson et al. (1979) found an increased bone mineral content in the distal end of the forearm in women with primary coxarthrosis. Roh et al. (1974), studying coxarthrosis patients, found an increased bone mineral content in metacarpal bones and in the shafts and the distal end of the forearm. These studies could imply a decreased incidence of fractures in coxarthrosis patients. The finding in the present study of an increased number of fractures in the coxarthrosis patients (I) is surprising, unless fracture is of an etiological importance.

In the studies of coxarthrosis in Malmö we used colon roentgen to calculate its prevalence (III). An increased frequency of colon roentgen examinations in coxarthrosis patients might influence the prevalence data.

It is obvious that coxarthrosis patients do not have an increased mortality rate (II). The decreased mortality rate in elderly operated women is probably explained by the process of selection for operation.

If external factors are responsible for the development of cox-

arthrosis one could expect a change in prevalence between the two studies on colon examinations (Danielsson 1966) (III). During the last decades the work environment has probably improved. Also, the fact that there is no sex difference in the prevalence of coxarthrosis indicates that mechanical factors are of minor importance. Also, the normal prevalence of primary coxarthrosis in shipyard workers (IV) supports this theory.

It is difficult to find and exclude cases with secondary coxarthrosis. The survey of the archives of the Orthopedic and Roentgen Departments are, however, an optimal instrument to do this - data from long ago are available.

There is evidence in earlier studies that coxarthrosis occurs more often together with other arthritis (Marks et al. 1979, Brewerton 1983). Doherty et al. (1983) found that subjects with arthrosis in the hands more often developed primary and secondary gonarthrosis. The inter-relationship between coxarthrosis and other arthrosis is unclear. Kraus et al. (1978) indicated a familial coincidence of coxarthrosis and other osteoarthritis. The significantly increased prevalence of coxarthrosis in siblings of patients with coxarthrosis demonstrated in our study (V) is difficult to ignore.

As in all epidemiology of diseases with multiple causes, the outcomes of these studies are only partly conclusive. Nevertheless, our failure to demonstrate any difference between men with different types of work taken together with previous data, support the concept that external factors such as labor are of little importance for the etiology of most cases of coxarthrosis which are today considered as primary. Similarly, the sibling data, although not in themselves conclusive of coxarthrosis as a hereditary disease, point to the possibility of mainly endogenous factors being responsible for the condition, in the same way as does its bilaterality and sex distribution. Furthermore, changes in our life-style may be the cause of the change of the pattern of disease, such as the increased risk of hip fracture (Johnell et al. 1984) and the changing risk of cardio-vascular disease (Stamler and Stamler 1984). Coxarthrosis, on the other hand, has

remained unchanged over decades, just as may be expected of a hereditary condition in the elderly.

SUMMARY AND CONCLUSIONS

Epidemiological studies on primary coxarthrosis were performed by collecting data from the Orthopedic Department and the Roentgen Department of the Malmö General Hospital. Further data were collected from the Roentgen Department of two private medical practices in the city and the Roentgen Department of the Geriatric Hospital.

In 279 patients, operated on due to primary coxarthrosis, and in 279 age- and sex-matched controls, the occurrence of fractures and diseases of ageing and the frequency of roentgen examinations was calculated. In the coxarthrosis patients the occurrence of fractures and the frequency of roentgen examinations was increased. There was also a tendency towards a higher morbidity caused by diseases related to ageing, with the exception of diabetes.

The mortality rate in 974 patients with primary coxarthrosis operated on with total hip replacement was calculated. In elderly women - age > 70 years - with coxarthrosis, the mortality rate was decreased after the first post-operative year. In men - age > 70 years - there was an increased mortality rate, however, though not quite statistically significant, after the first post-operative year following revision.

In a survey of 4,027 normal double contrast colon roentgen examinations, the prevalence of primary coxarthrosis was calculated. The total prevalence of primary coxarthrosis was 2.1 per cent, and, over the age of 55 years, 3.1 per cent. The disease was equally common in both sexes and bilateral coxarthrosis occurred in 35 per cent. These data were compared with the data from a similar examination of 3,903 normal colon examinations that had been performed more than 20 years earlier. It was concluded that the prevalence of primary coxarthrosis had not changed over the 20 years.

About 1/3 of the subjects with coxarthrosis in the recent study

were undiagnosed. The prevalence of primary coxarthrosis in 332 laborers in a shipyard who had been employed for decades in heavy work was calculated and compared with the prevalence in 352 internal and 438 external controls. The prevalence of primary coxarthrosis in the laborers was 3.3 per cent, in the internal controls 3.1 per cent and in the external controls 1.6 per cent. We failed to demonstrate any significant relation between occupation and primary coxarthrosis.

The prevalence of primary coxarthrosis in 289 siblings of patients operated on due to primary coxarthrosis was calculated to be 8 per cent. The prevalence of primary coxarthrosis in age- and sex-matched controls was 3.8 per cent. This difference was statistically significant and it was concluded that there was an increased familial prevalence of coxarthrosis.

Primary coxarthrosis is a disease with a fairly constant prevalence in the population. Endogenous factors seem to be of greater etiological importance than mechanical.

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PAPERS

I

COINCIDING MORBIDITY IN PATIENTS WITH COXARTHROSIS -
AN EPIDEMIOLOGICAL STUDY OF ROENTGEN EXAMINATIONS

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INTRODUCTION

The etiology of most cases of coxarthrosis (osteoarthritis of the hip joint) is unknown. However, coxarthrosis is a degenerative disorder of the joint associated with ageing. Danielsson¹ concluded that the morbidity of coxarthrosis is equal in both sexes. Furthermore, mortality is the same as in the general population. However, Solomon et al.² found that the prevalence of coxarthrosis differs significantly between somatotypes.

The purpose of this study was to analyze the occurrence of fractures and disease in coxarthrosis patients.

PATIENTS AND METHODS

The population of the city of Malmö is about 235,000. As demonstrated in repeated samples, almost 90 per cent of the citizens over the age of 65 have been examined in the Department of Radiology, Malmö General Hospital, at least once. The Radiology Record Room contains all the roentgen referrals with short case histories from 1950 onwards. The data in this study were taken from these referrals, covering the period 1950 - 1981. Included were 88 men and 191 women with primary coxarthrosis, who had undergone a total hip replacement between 1973 and 1976. At the time of the study their age was 73 ± 8 for the men and 74 ± 8 for the women. The patients' records and pre-operative roentgen films were carefully examined for signs of hip diseases other than

primary coxarthrosis - secondary coxarthrosis was not included.

Age- and sex-matched controls were randomly selected from the population records of the city - with the exception that subjects with known coxarthrosis were rejected and replaced by another random selection.

The records were searched in the same manner for coxarthrosis patients and controls. Special attention was paid to degenerative, age-related conditions which may have been the reason that a roentgen examination was ordered:

- Fracture - number, location and time
- Malignant disease
- Hypertensive disease (chest roentgen)
- Cardiacs (chest roentgen)
- Vascular disease (angiography)
- Diabetes
- Alcoholism (repeated trauma, liver disease, delirium tremens)

In addition, the frequency of three common roentgen examinations - gastric examinations, intravenous urography and colon examinations - was recorded.

RESULTS

The 279 coxarthrosis patients and the 279 controls had altogether had 5,025 roentgen examinations during the 31 years covered by the study. The coxarthrosis patients had had about 40% more roentgen examinations than the controls, even when those examinations which were a direct result of their coxarthrosis or its treatment are excluded (Table 1). Fractures which occurred prior to the operation were more common in the coxarthrosis cases (post-operative fractures in the controls are fractures occurring after the date of the operation of the age and sex mate) (Table 2). Fragility fractures - fractures in which the etiology of the fracture is known or suspected to be partially due to a decreased quality of the bone - such as trochanteric and cervical hip fractures, frac-

tures of the proximal end of the humerus, fractures of the rami of the pelvis, vertebral compression fractures, ankle fractures, fractures of the lateral condyle of the tibia and fractures of the distal end of the forearm, were, as may be expected, more frequent in women than in men, but there was no significant difference between coxarthrosis cases and controls. The difference, if any, was in favour of more fragility fractures among coxarthrosis cases. Fractures of the distal part of the femur, which may also have the qualities of a fragility fracture,³ all occurred in the operated leg of the coxarthrosis patients.

Table 1. Frequent roentgen examinations per 279 subjects.

	Coxarthrosis	Controls
Gastric, patients	92	81 (n.s.)
examinations	275	194 ($p < 0.001$)
Colon, patients	73	53 ($0.1 > p > 0.5$)
examinations	168	109 ($p < 0.001$)
Iv. urography, patients	59	50 (n.s.)
examinations	170	104 ($p < 0.001$)
Total number of roentgen examinations - coxarthrosis related examinations excluded	2934	2091 ($p < 0.001$)

Gastric examinations, colon examinations and intravenous urography were significantly more frequent in coxarthrosis cases than in controls, even if the number of patients involved in these examinations did not differ significantly between the two groups (Table 1). Of the common diseases related to ageing, only the occurrence of diabetes differed between the two groups in that not one single case could be detected in the Radiology Record Room on

the 279 coxarthrosis patients. There was a slight, but non-significant, preponderance for other conditions in the coxarthrosis cases (Table 3).

Table 2. Fractures in coxarthrosis and controls per 279 subjects.

	Coxarthrosis		Controls	
Total number	181		131	($p < 0.01$)
Patients with fracture, total	113		88	($p < 0.05$)
Patients with fracture, before op.	81		53	($p < 0.01$)
Patients with fracture, after op.	48		49	(n.s.)

	Men	Women	Men	Women
Fragility fractures, number	20	86	12	74
Distal forearm	5	37	3	29
Hip, cervical-trochanteric	3	7	3	9
Ankle	9	7	3	7
Distal part of femur	1	3	0	0

Table 3. Other conditions per 279 subjects.

	Coxarthrosis	Controls
Malignant tumour	38	24 ($0.1 > p > 0.05$)
Hypertension	40	31 (n.s.)
Cardiacs	23	20 (n.s.)
Obstructive arterial disease	11	12 (n.s.)
Alcoholism	6	5 (n.s.)
Diabetes	0	9 ($p < 0.01$)

DISCUSSION

Primary coxarthrosis is probably a sui generis disease - there is no sex predominance^{1,4} and the mortality is about the same as in the population at risk.¹ However, "primary" probably includes secondary cases, only that the pathogenetic factors have not yet been isolated. In the present study patients with conditions such as congenital dislocation of the hip, femoral head epiphyseolysis, Perthes' disease, rheumatoid arthritis, hip fracture, septic arthritis or idiopathic necrosis of the femoral head were excluded on the grounds of the information from records, referrals and pre-operative roentgenograms.

With regard to fracture, the suggested anti-coincidence between hip fracture and coxarthrosis^{2,5} was confirmed - no cervical hip fracture occurred in arthrotic hips. On the whole there were more fractures among the coxarthrosis patients, but those particular fractures that have been referred to as fragility fractures were not significantly more common in either group. We can offer no explanation for the increased risk of non-fragility fractures in coxarthrosis patients, unless trauma episodes are to some extent responsible for the development of the coxarthrosis. Fracture of the distal part of the femur, distal to the prosthesis, was not very frequent but had, on the other hand, occurred only in the coxarthrosis patients. Lindberg and Nilsson⁶ demonstrated that the loss of bone and - presumably - strength is comparatively small following total hip replacement as compared with other trauma of the same magnitude.

The various visceral roentgen examinations which were more commonly performed in coxarthrosis patients, may, indeed, be due to the hip disease. Coxarthrosis patients are less able to move around freely (constipation, kidney stones) and are usually big consumers of analgetic and antiflogistic drugs (gastritis, peptic ulcer). It is somewhat disturbing that the only studies of the true incidence of coxarthrosis have used the findings in colon contrast radiograms.^{7,8}

Does coxarthrosis protect the patient from diabetes? This would indeed be difficult to reconcile with our concepts of both diseases - Waine et al.⁹ found that osteoarthritis was more prevalent and severe in diabetic patients! Nevertheless, the difference between the controls and coxarthrosis patients was in this study significant, in spite of the fact that the coxarthrosis patients should have had a greater chance of having a latent diabetes discovered in the pre-operative examinations and in conjunction with the surgery. Also, in the controls the incidence of diabetes found in the Roentgen Record Room is no more than half of the expected incidence of diabetes presenting symptoms in contemporary data for the same age group.¹⁰ Diabetes would not be a contra-indication for hip surgery.

The selection of coxarthrosis patients in this study to include only patients who have undergone hip replacement procedures may introduce sources of error - only the healthiest may have been selected. It is therefore possible that an unselected group would have been more stigmatized by symptoms of ageing, other than coxarthrosis.

SUMMARY

In 279 patients who had been operated on with total hip replacement because of primary coxarthrosis, the occurrence of fractures, other diseases and the frequency of roentgen examinations was compared with the same variables in the same number of age- and sex-matched controls from the same population. Coxarthrosis patients had, before their hip operation, had significantly more fractures than the controls, but not after the operation, except for fracture distal to the femur implant, which was rare but occurred only in the operated patients. Fragility fractures, including hip fractures, did not differ in frequency between coxarthrosis and controls. There was a non-significant tendency to a higher morbidity in conditions related to ageing and degeneration - diabetes, however, was less frequent in coxarthrosis patients. Coxarthrosis patients had also undergone more frequent examina-

tions of their gastro-intestinal tract and their kidneys.

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II

THE OVERALL MORTALITY RATE IN PATIENTS WITH TOTAL HIP ARTHROPLASTY
WITH SPECIAL REFERENCE TO COXARTHROSIS

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ABSTRACT

The mortality rate was calculated in 1,385 patients with total hip arthroplasties compared with the population at risk in the period from 1968 to 1981. In elderly women with coxarthrosis, after the age of 70, the mortality rate decreased after the first post-operative year. There was no such effect in men. In women, there were no changes in mortality rate in those who had had revision operations, whereas in men operated on for coxarthrosis who were over the age of 70, there was an increased mortality rate after the first postoperative year following revision. Patients operated on for complications after hip fracture and/or rheumatoid arthritis had an increased mortality rate after the first postoperative year, including both women and men below age 70.

INTRODUCTION

Today, total hip arthroplasty (THA) is almost the supreme surgical treatment of hip disease in the adult. In 1982, more than 6,000 procedures were performed in Sweden,¹ which has a population of about eight million. The majority of the hip arthroplasties are performed because of coxarthrosis, which in itself has a mortality risk comparable with that of the normal population.²

The purpose of this study was to analyze the overall mortality rate in patients with total hip arthroplasty, particularly when it

was performed because of coxarthrosis.

PATIENTS

During the period August 1968 - January 1981, 1,627 primary hips in 1,385 patients were operated on with total hip arthroplasty in Dr. Lindberg and Dr. Carlsson's hospital in Malmö.

At the time of the hip operation, all patients but 18 were residents of the city of Malmö, where there is only one orthopedic department. Moreover, according to the Swedish insurance regulations, patients could not be operated on in any other department in Sweden.

From the national population records it was possible to confirm whether or not the patients were alive on February 1, 1981. Also, the time of death was available in deceased patients.

The mortality rate was compared with that in the city of Malmö. In each patients, sex, diagnosis, date of birth, and the date of hip operations were registered.

STATISTICAL METHODS

The usual technique when comparing the mortality rate in a certain cohort with that in some standard population is to compare the number of actually observed deaths in the cohort with the number of deaths that would have been expected had the cohort been subjected to the same death risks as those of the standard population. To find the first of these two quantities, the number of observed deaths, one must perform some simple book-keeping; finding the number of expected deaths requires some work.

As standard population, the authors decided to use the population of Malmö, for which age-, sex-, and calender-year-specific mortality rates could be computed from official sources. (The fact that

the mortality rates have to be age- and sex-specific is obvious; that they have to be calendar year-specific as well came as a slight surprise to the authors, but it turned out that the female mortality rate in Malmö declined slightly but statistically significantly during the 1970s).

To find the expected number of deaths in the authors' cohort, they calculated, for each person, the amount of time under risk that he/she contributed to each one-year age group for the appropriate sex; for reasons indicated above, they thereby made a separate computation for every calendar year. In addition to the three variables mentioned (age, sex, calendar year), the authors have two more: diagnosis and time since operation. They decided to use just two diagnoses: coxarthrosis and all other causes. To be more precise, each patient is, for the whole observational period, allotted to the diagnosis relating to the first operation on that patient. (In the authors' cohort there were four diagnosis switchers, i.e., patients with bilateral operations and with different causes for the two hips). As for time since operation, the authors imagined that if the operation causes an increase in the mortality rate, this increase is likely to wear off as time goes by, letting the patient slowly return to normal mortality. They used the following five classes (no. of years since last operation): 0-1, 1-2, 2-3, 3-4, 4+. This means that a patient returns to the first class as soon as he/she is operated on again, whether in the same hip as before or in the other hip.

Thus, the total time under risk in the authors' cohort was split up according to five criteria: two that are constant over time (sex, diagnosis), two that vary monotonically (age, calendar year), and one that increases, except for possible jumps back to zero (time since operation). In the resulting five-dimensional table (which of course could not be printed out but was stored in a computer), each entry was multiplied by the mortality rate in Malmö for the corresponding sex, age, and calendar year, giving the expected number of deaths connected with that entry. The size of this table of expected deaths was reduced first by summing over all calendar years, then by collapsing the age grouping into a

two-level grouping (50-69, 70+), and similarly for the time-since-operation grouping (0-1, 1+). An exactly analogous table of observed numbers of deaths was produced. Thus, the authors had two four-dimensional tables: one with the expected number of deaths for each sex, age group, time-since-operation group, and diagnosis and one with the actually observed number of deaths. For a given cell in such a table, the relative mortality rate is computed as the ratio of the observed number of deaths to the expected number, expressed in per cent. Values greater than 100% thus indicating overmortality; the statistical significance of such a relative mortality is judged by assuming the observed number of deaths to have a Poisson distribution. The same assumption also gives a method for constructing confidence intervals for the relative mortality rate.

A more comprehensive description of the statistical methods will be published as a technical report at the Department of Statistics, University of Lund, by two of the authors (JL and VH).

RESULTS

Coxarthrosis was the reason for 726 total hip arthroplasties in women and 428 arthroplasties in men (Table 1). In both sexes, the right hip had been replaced more often than had the left. In women, this difference was significant ($p < .001$). Revision arthroplasty was performed in 45 men and 36 women with coxarthrosis.

Table 2 shows the observed and expected deaths according to sex, age group, diagnosis, and time since operation.

The age at the time of the first THA in patients with coxarthrosis is presented in Figure 1. Since there was no sex difference, the data are pooled for both sexes.

The relative mortality rate in patients operated on because of coxarthrosis is presented as confidence intervals (Figures 2 and

Table 1. Distribution of patients (hips) between diagnostic groups and sexes *

	Women		Men	
	Patients	(hips)	Patients	(hips)
Coxarthrosis	619	(726)	355	(428)
Femoral neck fracture	143	(145)	53	(53)
Rheumatoid arthritis	73	(100)	24	(29)
Other	74	(94)	48	(52)

* Four women had bilateral operations but because of different diagnoses.

Table 2. Observed and expected number of deaths (observed/expected)

	Time since operation (yrs)	Women		Men	
		50-69	70+	50-69	70+
Coxarthrosis	0-1	4/2.96	9/9.46	7/4.42	7/8.77
	1+	8/9.40	52/69.09	13/16.06	45/46.55
All other diagnoses	0-1	2/1.25	6/4.03	3/1.32	1/1.53
	1+	10/3.46	14/17.06	9/3.11	8/5.66

3). It was concluded that, after the first postoperative year, the mortality rate was decreased in women older than 70 years, whereas the mortality rate in men could not be demonstrated to differ from that of the general population.

After the first postoperative year, the coxarthrosis men older than 70 who had been revised because of failed arthroplasties had an increased mortality rate. This difference, which was not quite statistically significant (Figure 4), did not occur in women.

The mortality rate in patients treated by THA because of complications following cervical femoral fracture, rheumatoid arthritis, and various other diseases was analyzed separately. In these patients, both women and men younger than 70 years of age had an increased mortality rate after the first postoperative year. The confidence intervals in Figure 5 represent both women and men since there was no difference between the sexes.

DISCUSSION

Pain is the prime indication for total hip arthroplasty, and a successful result usually implies that the patient can lead a more active life.⁵ An overwhelming majority of the operations are performed because of coxarthrosis, a disease that might be part of a generalized degenerative disorder and thus combined with an increased morbidity rate.⁴ However, in a study by Danielsson,² life expectancy in patients with coxarthrosis did not deviate from that of the standard population.

Pulmonary embolism is the most common cause of death within three months of the operation.³ The frequency of fatal pulmonary embolism varies, in studies not using prophylaxis, between 1.8% and 3.4%.⁶ In the authors' department, dextran-70 was administered as thromboembolic prophylaxis, and the frequency of fatal pulmonary embolism is reported to be 0.7%.³ Patients with previous bone or joint operations are running an increased risk of fatal pulmonary embolism.³ Therefore, infectious or non-

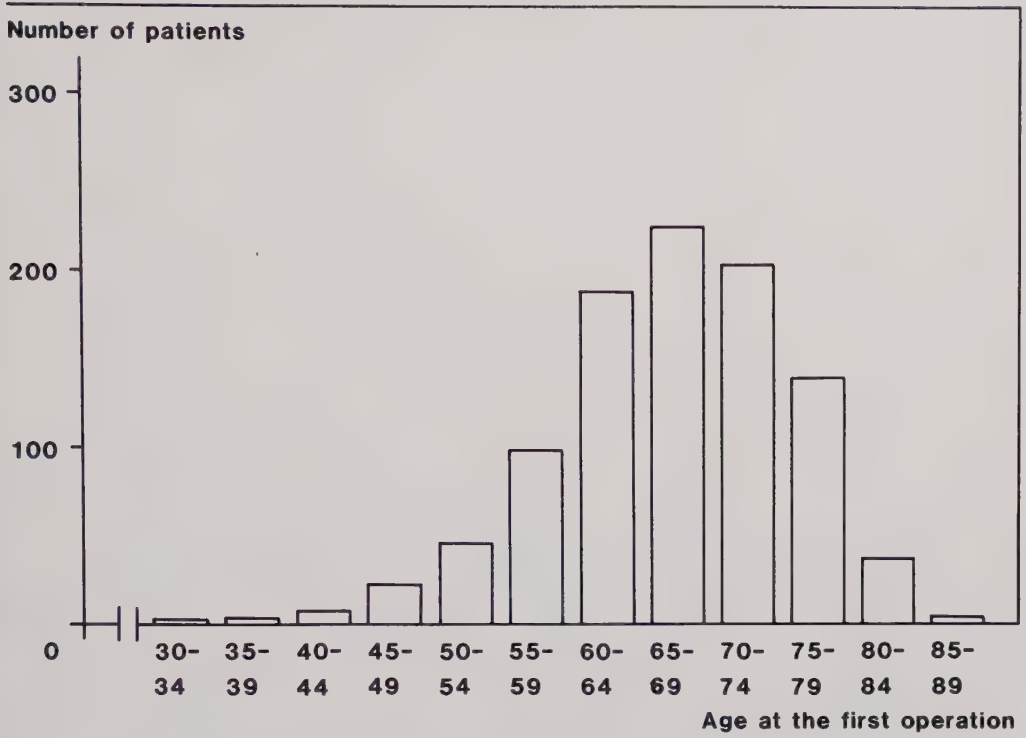


Figure 1. Age at the first operation in men (355) and women (619) with coxarthrosis.

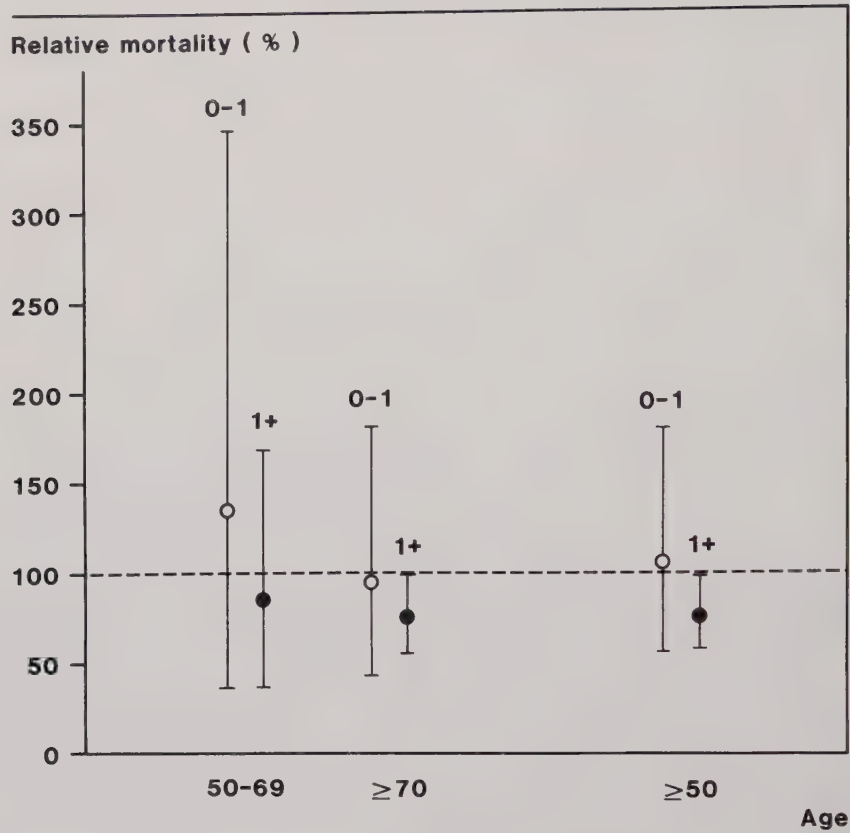


Figure 2. Point estimates and 95% confidence intervals for relative mortality rate among female coxarthrosis patients; 0-1 (1+): less (more) than one year after last operation.

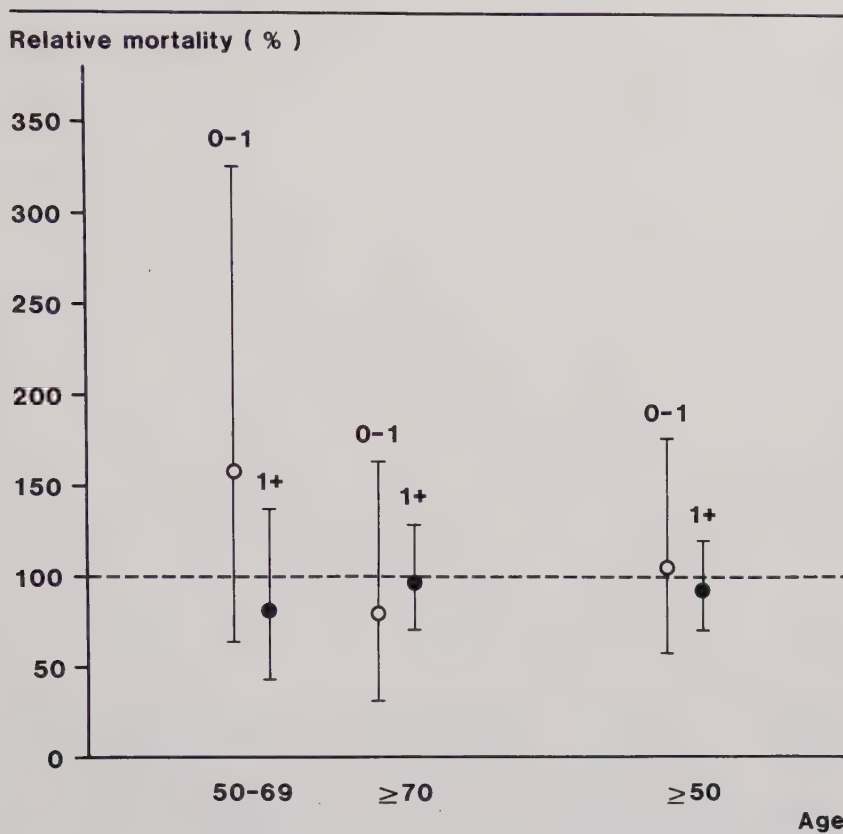


Figure 3. Point estimates and 95% confidence intervals for relative mortality rate among male coxarthrosis patients; 0-1 (1+): less (more) than one year after last operation.

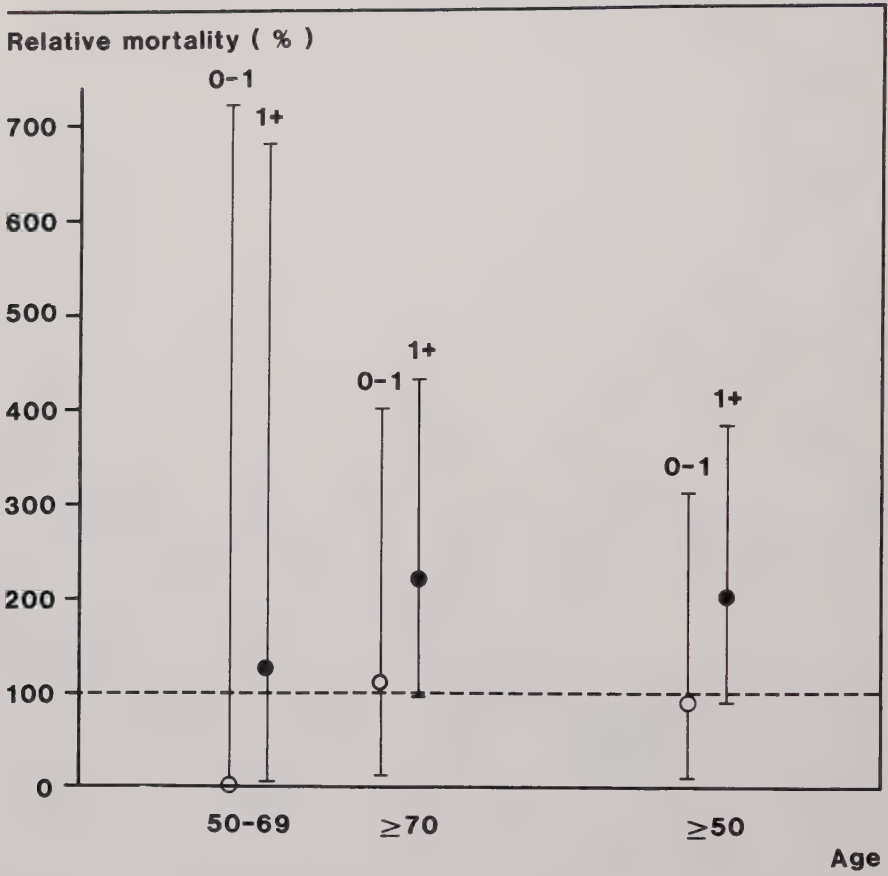


Figure 4. Point estimates and 95% confidence intervals for relative mortality rate among revised male coxarthrosis patients; 0-1 (1+): less (more) than one year after last operation.

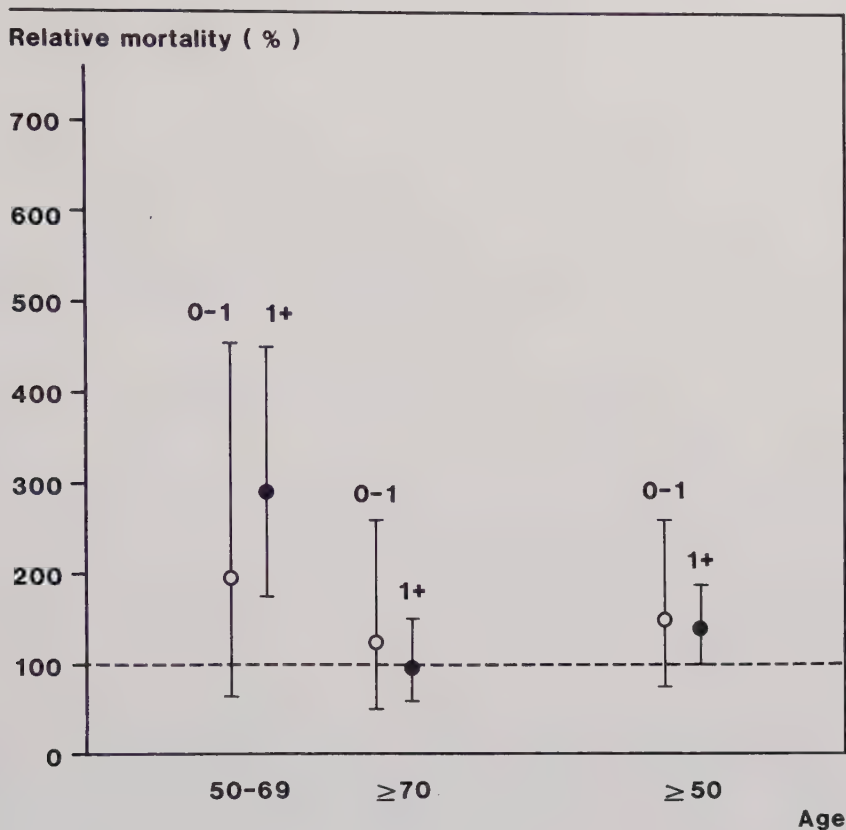


Figure 5. Point estimates and 95% confidence intervals for relative mortality rate among female and male patients with diagnoses other than coxarthrosis; 0-1 (1+): less (more) than one year after last operation.

infectious failures leading to revision must also be considered in a study concerning the overall mortality rate after total hip arthroplasty.

Other, though less common, causes of postoperative death are pneumonia and cardiac failures. All these circumstances and the suspicion that coxarthrosis is part of a more generalized degenerative disorder might imply an increased mortality rate. However, this could not be demonstrated in the authors' study.

In women older than 70, the mortality risk seemed to be below that of the standard population.

Patients younger than 70 treated by THA because of diagnoses other than coxarthrosis had an increased mortality rate after the first postoperative year. An increased mortality rate in patients with rheumatoid arthritis or a femoral neck fracture has previously been demonstrated by others.^{7,8}

With modern anesthesiologic methods, very few patients are denied total hip arthroplasty for medical reasons. Nevertheless, a selection of patients for surgery is, at present, the only reasonable explanation for the decreased mortality rate in elderly women.

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III

PREVALENCE OF COXARTHROSIS

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ABSTRACT

In a survey of 4,027 double-contrast colon roentgenograms, the hip joints were examined and classified with regard to the presence or absence of primary coxarthrosis (osteoarthritis of the hip). The hips were graded according to type and severity of coxarthrosis. The data collection was performed in precisely the same manner as in an earlier study undertaken on 3,903 similar examinations that had been performed more than 20 years earlier. During this time period, the prevalence had not changed, nor was there any change in sex ratio or distribution between bilateral and unilateral cases or between types of coxarthrosis. Also, the severity of the coxarthrosis at the time of the examination was approximately the same. A considerable portion of the patients, about one third in the recent study, had not been previously diagnosed. In this group, mixed and medial coxarthrosis were more common among men than was lateral coxarthrosis. There was no difference in age or sex between previously diagnosed and undiagnosed groups of coxarthrosis. In the recent study, about one third of the patients had been treated mostly by total hip arthroplasty (THA). In these patients, lateral coxarthrosis was more common. Women were over-represented among the THA cases, even though their coxarthrosis was not more severe.

MATERIAL AND METHODS

The material consisted of clinical data and roentgenograms of patients in whom double-contrast roentgenography of the colon was

normal. All the patients were residents of Malmö, an industrial town in Southern Sweden, and all were 40 years old or older at the time of the roentgenographic examination.

Early study

Clinical and roentgenologic data were collected from the roentgen films, the orthopedic patient charts, and the roentgen referrals in 3,903 subjects - 1,965 men and 1,938 women - who had undergone double-contrast roentgenography of the colon⁹ with a negative outcome, i.e., without any pathologic findings in the colon. An additional condition was that both hips appeared in the films with a clarity suitable for evaluation of coxarthrosis; only a few cases had to be discarded on such grounds.

All subjects were residents of the city of Malmö (population approximately 250,000) and were over 40 at the time of the colon roentgen examination, which was undertaken in 1962 and the preceding decade. The age and sex distribution is demonstrated in Table 1.

Coxarthrosis was roentgenologically defined in accordance with Danielsson^{1,2} and classified in agreement with Danielsson¹ and Danielsson et al.³ Structural and/or joint space changes were thus criteria for the diagnosis of coxarthrosis in this investigation. The presence of osteophytes alone did not satisfy the roentgenographic criteria for the diagnosis.¹

The hip joint space was regarded as abnormally decreased when found to be less than 4 mm in patients younger than 70 or less than 3 mm in patients 70 years old and older.²

Also, the joint space was interpreted as being abnormally decreased if it was more than 1 mm lower than the joint space on the contralateral side.²

The severity of radiographic changes was estimated according to Heripret.³ Increasing class number implies increased severity of radiologic changes, 0 being normal.

The localization of radiographic changes was classified as lateral, medial, or mixed in type.¹

Cases with a history of secondary coxarthrosis of a roentgen appearance suggesting secondary coxarthrosis were excluded.

Recent study

This study was repeated in the same manner and with the same investigator (L.D.) examining the films. The sample was now 4,027 subjects - 1,957 men and 2,070 women - with a normal colon roentgen examination undertaken during the years 1975 - 1982.

For both samples the records were searched for information on surgical hip procedures undertaken before the colon roentgen examination by which the individual subjects had been admitted to the study, and on whether or not the hip(s) had been examined roentgenographically in the past so that the diagnosis was already known.

In many instances, the operation in the recent series was a total hip arthroplasty. In such cases, the diagnosis and classification of coxarthrosis was undertaken with preoperative films. In one of the women these films were lost, and her coxarthrosis could not be classified. Since roentgen referrals and reports in the city of Malmö have been collected in a folder for each individual since 1950, it was also possible to find old hip roentgen examinations.

RESULTS

Prevalence

In the recent study of 4,027 subjects, 83 (41 men and 42 women) had primary coxarthrosis (Table 1). The prevalence of primary coxarthrosis increased from less than 1% in the age groups below 55 to about 7.5% in the 80-90-year age groups (Figure 1).

There was no sex difference between age groups in the prevalence of primary coxarthrosis (Table 1). Primary coxarthrosis was

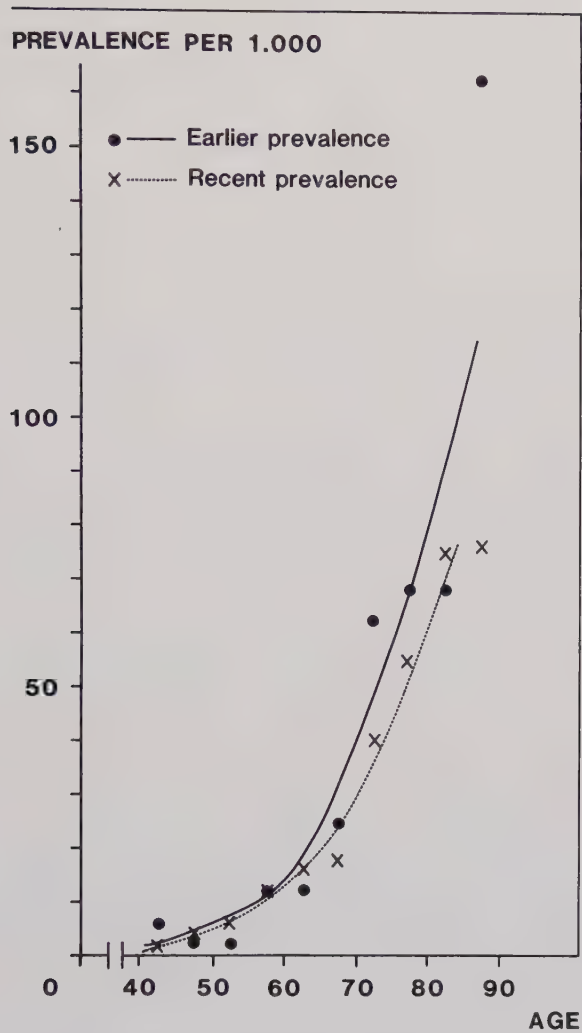


Figure 1. Prevalence of roentgenologic primary coxarthrosis in subjects who have had a colon roentgen examination.

bilateral in 35% (12 men and 17 women). Severity and type of coxarthrosis did not differ between the sexes.

Roentgenography of the hip due to coxarthrosis had previously been performed on one occasion or more in 55 patients. Thus, 28 coxarthrosis cases were previously undiagnosed. This group was studied separately, and so was the group of subjects who had undergone surgery.

Group previously undiagnosed roentgenologically

The frequency of roentgenologically undiagnosed primary coxarthrosis, both unilateral and bilateral, did not differ between the sexes (Table 2). Cases with unilateral coxarthrosis (22/54) more often seemed to be previously undiagnosed than were cases with bilateral coxarthrosis (6/29) but the difference was not statistically significant ($.1 > p > .05$). In men with previously roentgenologically undiagnosed unilateral coxarthrosis, the mixed and medial type and less severe structural changes were more common ($p < .05$) than in men with previously diagnosed coxarthrosis.

Table 2. Number of subjects with primary coxarthrosis previously undiagnosed in roentgenograms of the hip/total number - classified according to sex and occurrence of bilateral localization.

	Unilateral	Bilateral	Total
Men	13/29	1/12	14/41
Women	9/25	5/17	14/42
Total	22/54	6/29	28/83

Operated group

The frequency of operation was higher ($p < .01$) among women (21/42) than among men (8/41) with primary coxarthrosis.

The roentgenologic localization of unilateral coxarthrosis did not differ between the sexes (Table 3). More patients ($p < .05$) were operated on in the group with lateral coxarthrosis than in the groups with mixed or medial coxarthrosis. More women than men ($p < .05$) were operated on in the groups with mixed and medial coxarthrosis, and the tendency was the same in the group with lateral coxarthrosis.

The frequency of double floor did not differ between the sexes but was higher ($p < .01$) in the operated than in the non-operated group. More women than men ($p < .05$) had been operated on in the group without double floor.

The general tendency was that more women than men were operated on with roentgenologically less severe primary coxarthrosis (Table 4).

The analysis of factors predisposing subjects to be roentgenologically undiagnosed or operated on was undertaken on unilateral cases only. Adding the bilateral cases to the comparison of operated and non-operated cases did not change the outcome of the analysis.

Comparison of early and recent studies

There was a slight tendency for a decreased age-specific prevalence (Figure 1) in the recent study as compared with the early. Sex ratio, rate of bilateral disease, and type and severity of changes did not differ between the two studies. In the early study, 47% of the coxarthrosis cases diagnosed on colon roentgen were previously unknown, as compared with 34% in the recent study. This difference was not quite significant ($p < .1$). In both early and recent studies, lateral coxarthrosis was more severe than medial, and more cases with lateral coxarthrosis were treated by surgery.

Table 3. Number of subjects with unilateral primary coxarthrosis classified according to roentgenological localization and operation.

	Lateral			Mixed			Medial			Total		
	Op	No op	Total	Op	No op	Total	Op	No op	Total	Op	No op	Total
Men	3	7	10	0	12	12	0	7	7	3	26	29
Women	6	2	8	2	5	7	3	6	9	11	13	24
Total	9	9	18	2	17	19	3	13	16	14	39	53

Table 4. Number of subjects with unilateral primary coxarthrosis classified according to roentgenological severity and operation.

Osteophytes											
0				1				2			
Total				Total				Total			
Op	No op	Total	Op	No op	Total	Op	No op	Total	Op	No op	Total
Men	0	8	0	4	4	3	11	14	0	3	3
Women	0	3	3	3	6	5	6	11	3	1	4
Total	0	11	3	7	10	8	17	25	3	4	7
Joint space changes											
0				1				2			
Total				Total				Total			
Men	0	1	1	19	20	2	4	6	0	2	2
Women	0	0	0	10	14	4	1	5	3	2	5
Total	0	1	1	29	34	6	5	11	3	4	7
Structural changes											
0				1				2			
Total				Total				Total			
Men	0	10	0	11	11	3	5	8	3	26	29
Women	0	4	3	6	9	8	3	11	11	13	24
Total	0	14	3	17	20	11	8	19	14	39	53
Double floor											
Yes				No				Total			
Total				Total				Total			
Men	3	4	7	0	22	3	26	29			
Women	5	0	5	6	13	11	13	24			
Total	8	4	12	6	35	14	39	53			

DISCUSSION

Colon roentgen examinations usually offer significant information for a correct diagnosis and classification of coxarthrosis.⁵ This approach has been used by Danielsson² and Jørring.⁷ Lindberg⁸ found that coxarthrosis cases had undergone colon roentgen examinations more often; the deviation, however, was not sufficiently great to significantly change the outcome of the present study.

It was necessary to use the same classification in the recent study as in the early. However, Fredensborg and Nilsson⁴ found the lower normal limit for hip joint space in roentgenograms to be 3 mm in all age groups. Therefore, the cases classified as coxarthrosis in the recent study were reclassified with 3 mm joint space as the limit. Not one single subject changed from coxarthrosis to normal because of this re-estimation.

Even if roentgendiagnostic procedures were used less frequently in the fifties than they are today, the double-contrast colon roentgen examination in Malmö was introduced early and used liberally. In the fifties, approximately 2,000 colon examinations were performed annually, as compared with about 3,000 today.

Recent studies, also in Sweden,^{6,10} indicate an enormous increase in the risk of hip fractures in the elderly that has taken place in the last few decades. However, there is evidence in the present study that the prevalence of coxarthrosis, the other dominating hip disease in the older age groups, has, if not decreased, at least remained unchanged over the years. The small changes apparent in the octogenarians are not significant. Also, with respect to its roentgenologic appearance, primary coxarthrosis does not appear to have changed its nature over the last two decades.

A considerable proportion of the patients with coxarthrosis detected in a colon roentgen examination had not been previously examined, i.e., there was no roentgen diagnosis of their cox-

arthrosis. This group had decreased somewhat in the recent study, but still about one third had not had their coxarthrosis diagnosed. The reason the patients had escaped detection in the past was probably that they had no pain or only mild pain. Danielsson¹ and Jørring,⁷ in follow-up studies of coxarthrosis cases diagnosed earlier, found that a considerable portion were painless (13% and 20%, respectively).

In the earlier study, very few patients had undergone surgery. This was before total hip arthroplasties were introduced. In the recent study, the colon roentgen examination revealed an operated hip, mostly total hip arthroplasty, in not less than 29 of the 83 subjects with coxarthrosis. Jørring⁷ found that women older than 60 had a more severe coxarthrosis than men, although coxarthrosis was not more frequent in women. In the present study, the authors were unable to demonstrate that women had more severe coxarthrosis. Nevertheless, they had been operated on more frequently than men, and often because of a radiologically less severe coxarthrosis.

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IV

THE RELATION BETWEEN LABOR AND COXARTHROSIS

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ABSTRACT

Three hundred thirty-two laborers in a shipyard, all of whom had been working for decades in heavy industry, were compared with regard to the occurrence of coxarthrosis with a similar sized group of white-collar workers and with a random population sample. All three sets of men were of the same age. About one-fourth (the same in all three groups) had been referred for a hip roentgenographic examination at some time over the previous decades. In the group of laborers and their white-collar controls, coxarthrosis occurred in about 3%, with no difference between the two samples. The occurrence was less, but not significantly less, in those men who had been randomly selected from the population.

INTRODUCTION

In a recent ruling in a Swedish workmen's compensation case, a middle-aged man was awarded compensation on the grounds that he had strained his hip joints on his job and had contracted bilateral coxarthrosis (osteoarthritis of the hip).⁵ In the ensuing discussion, there was a conspicuous lack of references to actual data. Even if the professional opinion among orthopedic surgeons is that primary coxarthrosis is most likely not caused by external causes such as sport or heavy labor, this opinion is by no means shared by the public. The expression "wearing rheumatism" has been used to describe degenerative joint disease - arthrosis. A study in the past that has probably influenced our attitude toward a possible harmful influence of labor on the human joints was con-

ducted by Kellgren and Lawrence,⁶ who found that rheumatism was more common among coal miners than in a control group.

The objective of the present study was to compare the occurrence of coxarthrosis in men performing heavy labor and in men who were white-collar workers or whose professions were unknown.

MATERIAL

The study included 332 men who had been performing heavy labor in a Malmö shipyard. With regard to their trades, they were subdivided into the following groups: welders, 75; sheet-metal workers, 72; general laborers, 47; filers, 34; pipe-fitters, 19; others performing heavy labor, 85 (including over 20 trades). Age, time of birth, and duration of employment is demonstrated in Table 1.

Table 1. Subjects included and the outcome of the search for coxarthrosis.

	Laborers	Internal controls	External controls
Number	332	352	438
Age (yrs)	66 $\pm$ 5	64 $\pm$ 4	65 $\pm$ 5
Year of birth	1904-1922	1902-1924	1904-1922
Working years	32 $\pm$ 9	29 $\pm$ 7*	
Hip roentgenographic examinations (%)	28	24	26
Coxarthrosis	11 (3.3%)	11 (3.1%)	7 (1.6%)

* Shipyard white-collar workers.

Internal controls

One hundred seventy-nine white-collar workers from the offices of the same shipyard were selected as controls. Since the sample exhausted the entire population available, 173 male teachers employed by the city of Malmö were added in order to obtain a sample size similar to that of the men involved in heavy labor. Teachers and white-collar workers were matched for age with the laborers.

External controls

Finally, a random sample of men was drawn from the population records of the city of Malmö - 438 men matched for age with laborer and white-collar worker samples. In this group, the professions were not known.

METHODS

In the Department of Diagnostic Radiology at the authors' hospital there is a folder containing all the roentgen referrals and reports for individual residents from 1950 on. More recently, in the 1960s, private roentgen departments opened in the city. Finally, in a geriatric hospital, there is a roentgen department that is also serving the public by examining ambulatory patients.

All these roentgen facilities were searched with regard to roentgenographic examinations in the 1,122 men included in the study. Whenever the roentgenographic report described anything but a normal hip, the films were reviewed and classified with regard to the absence or presence of coxarthrosis. The diagnosis of coxarthrosis was accepted if there was a reduction of the joint space to less than 4 mm in patients younger than 70 and to less than 3 mm in patients older than 70, or a reduction greater than 1 mm as compared with the contralateral side in unilateral hip disease.

The hips with coxarthrosis were subdivided into lateral, medial, and mixed types, and the severity was further classified with regard to the severity of osteophytosis, structural changes, the

occurrence of double-floor, and joint-space changes. All classifications were made according to the method of Danielsson et al.³ The classification was performed by the same investigator who classified the cases of Danielsson^{1,2} and Danielsson et al.⁴ In conjunction with this classification every case was searched for possible injuries, diseases, or deformities that might have been the cause of secondary coxarthrosis. One case of hip tuberculosis and one of epiphysiolysis were excluded (not accepted as primary coxarthrosis). Both of these men belonged to the internal control group. The investigator who examined the roentgenograms was not aware of their origin.

RESULTS

Approximately one-fourth of all the subjects had had a hip roentgenographic examination during the previous decades (1950 - 1982); in this respect, there was no significant difference among the three groups (Table 1). About 3% of the subjects from the shipyard had received the roentgenologic diagnosis of coxarthrosis during this period; this was the same for laborers and white-collar workers (including teachers). Among the external controls - the sample randomly selected from the male residents of the city - the occurrence of coxarthrosis was somewhat less, but not significantly so.

The types of coxarthrosis (medial, lateral, and mixed) were evenly distributed among the three groups. The severity of coxarthrosis (classified with regard to osteophytosis, double-floor, structural changes, and joint-space reduction) did not differ among the three groups.

DISCUSSION

With the data of Danielsson et al.⁴ it is possible to calculate the expected prevalence of coxarthrosis in a group of men with the same age distribution as the subjects involved in the present study, taking into account that about one-third of the coxarthrosis cases may have remained undiagnosed. The expected prevalence is then 1.5%, which is very similar to that of the external controls. There is no explanation for the non-significant difference in the shipyard/teacher group; the rate of roentgenographic examinations was the same in all groups.

It was not possible to determine any significant difference between laborers and white-collar workers in the present study. Kellgren and Lawrence,⁶ in studying coal-miners, found two coxarthrosis cases in a group of 94 laborers and could not demonstrate any increased risk of this condition, whereas they found increased rates of gonarthrosis, still not significant, and a significantly increased rate of deforming spondylosis. Pogrand et al.⁹ compared three subsets of the Jewish population of Jerusalem that were subjected to varying degrees of labor-related strain and found no differences between the groups in the occurrence of coxarthrosis. Kraus et al.⁸ failed to demonstrate any relation between physical activity and coxarthrosis but found a positive relation between the occurrence of coxarthrosis and higher education. Klünder et al.⁷ found an increased rate of coxarthrosis among former soccer players who had reached middle age; the very high rate of coxarthrosis among soccer players, as well as that of the controls, however, indicates that perhaps unusual criteria were used for classification. There is also some disagreement concerning the importance of body weight. Saville and Dickson¹⁰ found no relation between body weight and coxarthrosis, whereas Kraus et al.⁸ found that patients referred for hip replacements were heavier than normal. Danielsson¹ found that coxarthrosis patients who were over-weight also had worse symptoms.

In conclusion, the present study is in agreement with most of

those studies in the past that have failed to demonstrate any significant relation between occupation and coxarthrosis.

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V

PREVALENCE OF PRIMARY COXARTHROSIS IN SIBLINGS OF PATIENTS WITH
PRIMARY COXARTHROSIS

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ABSTRACT

The prevalence of primary coxarthrosis in 289 siblings to 184 patients - operated on with total hip replacement because of primary coxarthrosis - was examined. Age- and sex-matched persons from the city files of Malmö were selected as controls. The prevalence of presenting symptoms (inducing a hip roentgen examination) of primary coxarthrosis in the siblings was 8% compared to 3.8% in the controls ($p < 0.05$).

The type and localization of primary coxarthrosis was evenly distributed between the two groups. On the other hand the prevalence of gonarthrosis did not differ between the two groups. The increased prevalence of primary coxarthrosis in the siblings suggests the influence of a hereditary factor in the etiology of primary coxarthrosis.

INTRODUCTION

There is little evidence for the heredity of arthrosis (osteoarthritis). One exception is the familial occurrence of Heberden nodes,^{16,17} another is the occurrence of generalized osteoarthritis involving more than four sets of joints.¹⁰ Further, external factors - labor and sports - have been suspected to contribute to arthrosis, also arthrosis of the hip (coxarthrosis). However, in a recent study on shipyard workers we found the same prevalence of coxarthrosis in men doing heavy labor

as in white collar workers.¹²

The purpose of the present study was to investigate the prevalence of primary coxarthrosis in siblings of patients operated on for primary coxarthrosis.

PATIENTS AND METHODS

Included in the study were 184 patients, 66 men, age 73 ± 7 and 118 women, age 73 ± 6 , who had been operated on with a total hip replacement because of primary coxarthrosis. They were all interviewed and reported altogether 289 siblings, 125 men, age 72 ± 6 and 164 women, age 73 ± 8 , who were also residents of the city of Malmö. Their identity was confirmed in the city files.

In the files - available by computer terminal - one person of the same age and sex, namely the next person in the file, was selected to serve as a control.

In the Department of Diagnostic Radiology in the Malmö General Hospital roentgen referrals and reports have been collected in folders for each patient since 1950. Also, two private roentgen facilities and the roentgen service in the geriatric hospital were available, so that all hip roentgen examinations that have been performed in the city during the past 33 years could be checked. The health insurance system is a severe limitation for residents to have roentgen examinations done elsewhere.

All the subjects involved, 289 siblings and 289 controls, were examined in the same way with regard to coxarthrosis. Whenever any finding other than normal was reported, the roentgen films were reviewed. All cases who had radiological signs of secondary coxarthrosis or whose roentgen file or hospital records contained observations indicating or giving rise to a suspicion of secondary coxarthrosis were rejected. The health care system of the city and the records would, very probably, reveal any incident of childhood hip disease, infection or trauma, even if the diagnosis of

secondary hip disease may be difficult or impossible to secure in a radiogram showing coxarthrosis.

The diagnosis of coxarthrosis was accepted only in subjects where the space in the hip joint was reduced to less than 4 mm before the age of 70, and to less than 3 mm thereafter. In unilateral cases a joint space reduction of more than 1 mm compared with the contra-lateral hip was also classified as coxarthrosis.⁴

The coxarthrosis cases were then subdivided into lateral, medial and mixed types. Also, the severity of coxarthrosis with regard to osteophytosis, structural changes, joint space changes and the occurrence of a double floor was recorded. The classification according to Danielsson et al.⁵ was used.

From each of the two groups, three patients were rejected since their conditions could be classified as secondary coxarthrosis, being residuals of epiphyseolysis, Perthes' disease, rheumatoid arthritis (2), femoral head necrosis and congenital dislocation of the hip.

Both sets of subjects were examined with regard to the occurrence of gonarthrosis in exactly the same manner. Here, the criteria of Ahlbäck¹ were used (the joint space narrower than half the width of the other articulation in the same joint or in the same articulation of the contra-lateral knee). Also, joints with a joint space of less than 3 mm were classified as gonarthrosis.

RESULTS

The prevalence of coxarthrosis and gonarthrosis in siblings and controls is presented in Table 1, showing significantly more subjects with coxarthrosis in the siblings. Subjects with bilateral coxarthrosis were more common among the siblings than among the controls. The type of coxarthrosis and the severity of the disease were evenly distributed between the siblings and the controls. Gonarthrosis was equally common in the two groups.

Table 1. Subjects included and the outcome of the search for coxarthrosis and gonarthrosis.

	Siblings		Controls
Number	289		289
Age	73 $\pm$ 7		73 $\pm$ 7
Coxarthrosis	23 (8.0%)	(p < 0.05)	11 (3.8%)
Bilateral cox-arthrosis	10/23 (43%)	(0.1 > p > 0.05)	1/11 (9%)
Gonarthrosis	11 (3.8%)	n.s.	8 (2.8%)

DISCUSSION

Using the frequency of roentgen examinations undertaken because of presenting symptoms, is not a generally accepted method of measuring the prevalence of degenerative joint disease. However, in the future with our present standards of radiation safety, this will possibly be the only method available. In Malmö we are fortunate to have access not only to systematic records but also to a "captive" population. If the expected prevalence of presenting symptoms in the controls in the present study is calculated using the data of Danielsson et al.,⁶ the outcome is almost the same.

There is no evidence in the past that coxarthrosis is a hereditary disease. However, many of those conditions which cause secondary coxarthrosis are known to be hereditary, such as congenital dislocation of the hip,³ Perthes' disease,¹⁹ and slipped femoral epiphysis.¹⁴ Again, in the group usually classified as primary, unknown secondary cases may be hidden. Acetabular dysplasia which has been described as a familial condition²⁰ has also been suggested to be a common cause of coxarthrosis.¹³ There are several degenerative joint conditions which have been considered hereditary, particularly cases of generalized osteoarthritis¹⁰ and Heberden's nodes.^{16,17} Also, chondromalacia of the patella has been described as a familial condition.¹⁵ Again, there is a considerable disagreement as to whether these conditions are related to coxarthrosis.^{9,11,18,21}

The attempts to explain coxarthrosis as secondary to known or unknown pre-existing hip conditions⁷ are contradicted by the study of Byers et al.² who found that coxarthrosis usually developed in radiologically completely normal joints. Also, attempts to explain coxarthrosis from exogenous causes have failed.^{8,12} There is, at present, no way of estimating the influence of environmental and endogenous factors on the etiology of coxarthrosis. It is also difficult to establish a hereditary pattern in a fairly rare disease which presumably, if hereditary, has a low penetration. Nevertheless, the difference demonstrated in the present study between siblings of coxarthrosis patients and matched controls supports the concept of coxarthrosis as a hereditary condition.

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